Surface Interactions are Crucial for Bone Cell Mineralization

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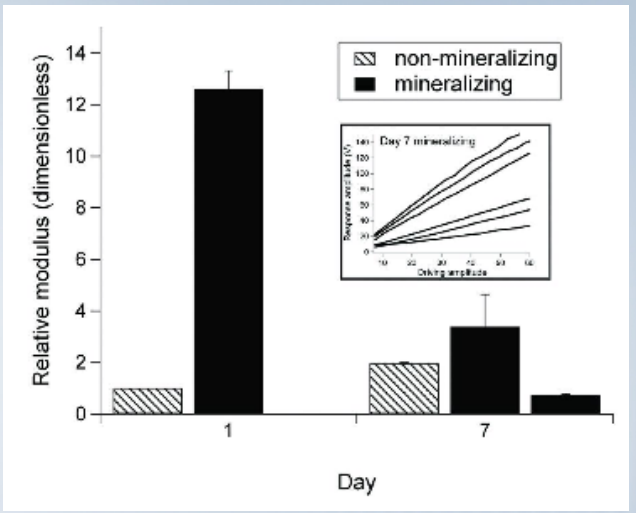
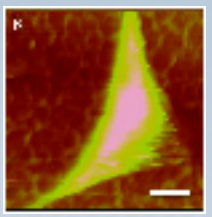
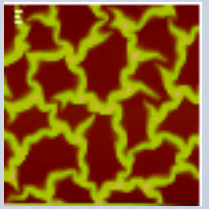
- Biomineralization, the process which creates new bone, depends not only on the health of cells but on the presence of appropriate extracellular matrix proteins (ECM). For the first time, this study compares mineralizing and non-mineralizing subclones of MC3T3-E1 osteoblasts on conducive substrates.
- By using scanning probe to measure elastic modulus of the ECM protein fibers, it was found that at very early time points, the mineralizing cells remodeled their matrix while the non-mineralizing cells did not. This research is unique in the field for its application of mechanical measurements to the ECM.
- Synchrotron x-ray diffraction confirms that hydroxyapatite (calcium phosphate bone mineral) is deposited *only* by cells whose genetic makeup *and* substrate properties allow the ECM remodeling to take place. The finding has important implications for bone implant materials.







Relative modulus is measured by Shear Modulation Force Microscopy for mineralizing and non-mineralizing osteoblast subclones. Note the bimodal distribution of fiber stiffness detected at day 7. AFM images show an osteoblast (10 micron scale bar) and the ECM fiber network (25 micron frame).

Yizhi Meng, Yi-Xian Qin, Elaine DiMasi, Xiaolan Ba, Miriam Rafailovich, and Nadine Pernodet, "Biomineralization of a Self-Assembled Extracellular Matrix for Bone Tissue Engineering," Tissue Engineering, A15, 355 (2009).

Work performed on Beamline X6B.